

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 094 330 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
19.03.2003 Bulletin 2003/12

(51) Int Cl.7: G01R 33/385

(43) Date of publication A2:
25.04.2001 Bulletin 2001/17

(21) Application number: 00308446.4

(22) Date of filing: 27.09.2000

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
• Petropoulos, Labros S.
Solon, Ohio 44139 (US)
• Schlitt, Heidi A.
Chesterland, Ohio 44026 (US)

(30) Priority: 18.10.1999 US 419597

(74) Representative:
van der Veer, Johannes Leendert et al
International Octrooibureau B.V.,
Prof. Holstlaan 6
5656 AA Eindhoven (NL)

(71) Applicant: Marconi Medical Systems, Inc.
Cleveland, Ohio 44143 (US)

(54) **Apparatus for magnetic resonance imaging and method of designing a gradient coil assembly**

(57) A gradient coil assembly generates substantially linear magnetic gradients across the central portion of an examination region. The gradient coil assembly includes primary x, y, and z-gradient coils which generate a gradient magnetic field (90) having a non-zero first derivative in and adjacent the examination region. Preferably, the gradient coil assembly includes secondary, shielding x, y, and z coils which generate a magnetic field which substantially cancels, in an area outside a region defined by the shielding coils, a fringe magnetic field generated by the primary gradient coils. The exist-

ence of a non-zero first derivative in and adjacent the examination region eliminates aliasing effects attributable to the non-unique gradient field values on either side of a rollover point (82). The non-unique values of the gradient magnetic field adjacent the rollover point caused structure near the rollover point to overlay each other. The unique non-linearity of the present gradient (90) adjacent the edges expands (magnifies) the image adjacent the edges. Because the expansion is unique, distortions at the edges are readily and accurately mapped back to linear.

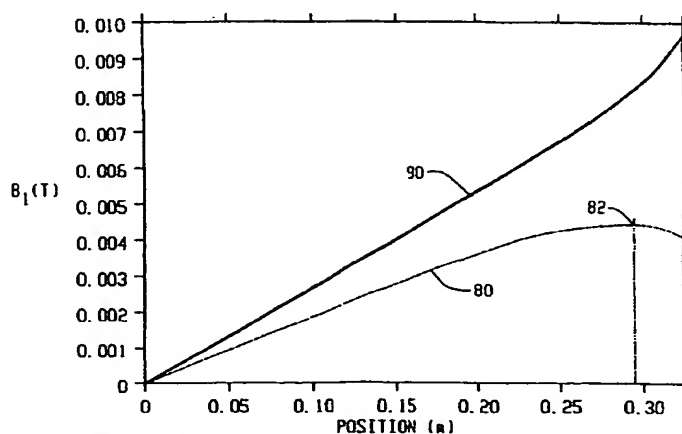


Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 8446

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 840 700 A (EDELSTEIN WILLIAM A ET AL) 20 June 1989 (1989-06-20) * column 7, line 40 - line 64 * * column 11, line 33 - line 61 *	1	G01R33/385
Y	---	2-4,8-10	
Y	EP 0 927 890 A (PICKER INT INC) 7 July 1999 (1999-07-07) * paragraph [0004] - paragraph [0010] *	2-4,8-10	
X	BREY W W ET AL: "A FIELD-GRADIENT COIL USING CONCENTRIC RETURN PATHS" JOURNAL OF MAGNETIC RESONANCE. SERIES B, ACADEMIC PRESS, ORLANDO, FL, US, vol. 112, no. 2, 1 August 1996 (1996-08-01), pages 124-130, XP000629730 ISSN: 1064-1866 * page 129, right-hand column, paragraph 2 - page 130, left-hand column, paragraph 4 *	1	
X	---		TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 009, no. 009 (P-327), 16 January 1985 (1985-01-16) & JP 59 157549 A (ASAHI KASEI KOGYO KK), 6 September 1984 (1984-09-06) * abstract *	1	G01R
X	---		
X	US 5 451 875 A (PATRICK JOHN L ET AL) 19 September 1995 (1995-09-19) * column 2, line 17 - line 22 *	1	
A	---		
A	US 5 296 810 A (MORICH MICHAEL A) 22 March 1994 (1994-03-22) * column 1, line 30 - column 2, line 66 * * column 3, line 37 - line 53 *	1-10	
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 23 January 2003	Examiner Skalla, J
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 8446

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-01-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4840700 A	20-06-1989	DE 3484976 D1	02-10-1991
		EP 0140259 A2	08-05-1985
		FI 843378 A ,B,	03-05-1985
		JP 6028206 B	13-04-1994
		JP 60132303 A	15-07-1985
EP 0927890 A	07-07-1999	US 6100692 A	08-08-2000
		EP 0927890 A2	07-07-1999
		JP 11276457 A	12-10-1999
JP 59157549 A	06-09-1984	JP 1657604 C	21-04-1992
		JP 3022172 B	26-03-1991
US 5451875 A	19-09-1995	US 5278504 A	11-01-1994
		US 5177441 A	05-01-1993
		US 5036282 A	30-07-1991
		US 5424643 A	13-06-1995
		DE 69218500 D1	30-04-1997
		EP 0519637 A1	23-12-1992
		JP 5269100 A	19-10-1993
		DE 69006935 D1	07-04-1994
		EP 0404461 A1	27-12-1990
		JP 2732141 B2	25-03-1998
		JP 3034403 A	14-02-1991
US 5296810 A	22-03-1994	US 5289128 A	22-02-1994
		US 5280247 A	18-01-1994
		DE 69325486 D1	05-08-1999
		DE 69325486 T2	28-10-1999
		EP 0587423 A1	16-03-1994
		JP 6277193 A	04-10-1994
		US 5406204 A	11-04-1995
		US 5424643 A	13-06-1995
		US 5349297 A	20-09-1994
		EP 0562708 A1	29-09-1993
		JP 6070908 A	15-03-1994
		DE 69318611 D1	25-06-1998
		DE 69318611 T2	10-09-1998
		EP 0562707 A1	29-09-1993
		JP 6070907 A	15-03-1994

EPO FORM P4589

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

This Page Blank (uspto)